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DIET SHIFT OF BARN OWLS (*TYTO ALBA*) AFTER NATURAL FIRES IN PATAGONIA, ARGENTINA

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The Barn Owl (*Tyto alba*) is broadly distributed in Argentina and is found in several types of habitats such as woodlands, grasslands, and semideserts (Canevari et al. 1991). Barn Owls feed primarily on small mammals, although prey species differ slightly among different localities even in the same geographic region (e.g., in Patagonia see Travaini et al. 1997, Pillado and Trejo 2000), which implies that owls show considerable plasticity and are opportunist predators, capturing the most abundant or vulnerable prey.

In this study we describe the diet composition of Barn Owls in a locality where the type of vegetation (and the associated small fauna) changed drastically after successive natural fires in the area. Our objective is to record any change in prey use before and after the fires to assess the impact of this disturbance on the owls' feeding behavior.

METHODS

The study site was located in northwestern Patagonia (41°03′S, 70°59′–71°00′W, 900 m above sea level). The area is a transition between the arid Patagonian steppe to the east and the humid *Nothofagus* forests to the west. The area is mountainous with rocky outcrops (with caves used by owls for roosting), and the vegetation is dominated by bunchgrasses (*Stipa speciosa*), cushion bushes (*Mulinum spinossum*), and scattered bushes (*Fabiana imbricata, Discaria articulata, Maytenus chubutensis,* and *Berberis buxifolia*). At times, low trees (*D. chacaye*) form small-gallery forests. Mean annual temperature is 8°C, and mean annual rainfall is 800 mm (Paruelo et al. 1998).

Diet of Barn Owls was studied from autumn–spring 1998 by analyzing pellets collected seasonally under two roosts (likely including 1–2 owl home ranges). We divided the yr into seasons: summer (December–February), autumn (March–May), winter (June–August), and spring (September–November). In the Austral summer 1998–1999, the area was affected by successive natural fires that destroyed most of the vegetation and left large patches of bare soil. The owls abandoned the known roosting sites, but did not leave the area. We continued collecting pellets in the summer and autumn 2000, after finding new roosts in an unburned area adjacent to the burned patches and not far from the abandoned roosting sites (ca. 300 m).

Pellets were air dried and dissected using standard techniques (Marti 1987). Prey remains in pellets were identified using keys (Pearson 1995) and by comparison with reference collections. Mammalian prey were classified to species and quantified by counting skulls and mandible pairs. Birds were identified to family level and quantified by counting skulls, while insects were classified to order and quantified by counting head capsules and mandibles.

Biomass of each prey category in the total biomass of the diet was calculated by multiplying mean body mass of individuals by the number of individuals in pellets and expressed as a percent of total prey biomass consumed.

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Geometric mean weight of prey (*GMWP*) in the diet was calculated following Marti (1987). Mean prey weights were taken from literature (Pearson 1983, Kramer et al. 1999), and from our own records. Mean weight of birds and coleopterans was taken from Donázar et al. (1997). Food-niche overlap (O) between diets in the pre- and post-fire periods was assessed by Pianka's (1973) index: $O = \Sigma p_i q_i / (\Sigma p_i^2 \Sigma q_i^2)^{1/2}$, where p_i is the frequency of a prey type in 1998, and q_i is the frequency of the same prey type in 2000. It ranges from 0 (no overlap)–1 (complete overlap). To test for differences in frequencies of prey categories in the diet among seasons, and before and after fires, we used contingency tables analyzed using G-tests of independence (Zar 1996). We grouped less common prey species so <20% of the expected frequencies was <5. We attained that by lumping all species with an observed frequency >4. The criterion for statistical significance was $P < 0.05$.

RESULTS

Our results revealed that Barn Owls fed largely on rodents (99.7% and 95.7% of the total prey items in 1998 and 2000, respectively), although they also consumed a small number of lagomorphs, birds (Emberizidae) and coleopterans (Table 1). The mean number of prey/pellet was 1.7 (SD = 0.8; range = 1–4; $N = 221$) in 1998 and 2.4 (SD = 1.3; range = 1–5; $N = 58$) in 2000 associated with a higher consumption of smaller-size prey (Table 1).

There were significant differences in diet composition among seasons in 1998 ($G = 36.3$, df = 8, $P < 0.05$), maybe related to fluctuations in prey population abundance throughout the yr. However, we note that in 1998, *Reithrodon auritus, Loxodontomys micropus, Abrothrix longipilis,* and *Oligoryzomys longicaudatus* made up 70–90% of total number of prey in all seasons. We found no significant differences between the two seasons sampled in 2000 ($G = 6.0$, df = 2, $P > 0.05$). Consequently, we pooled data for further analysis. We found significant differences ($G = 197.9$, df = 5, $P < 0.05$) in diets between 1998 and 2000. *Reithrodon auritus* decreased, *L. micropus* and *O. longicaudatus* almost disappeared, and *Eligmodontia morgani* showed a marked increase (from 3% in 1998 to >50% in 2000). *Reithrodon auritus* contributed most to the prey biomass in both yr, followed by *L. micropus* in 1998, and by *E. morgani* and *Ctenomys haigi* in 2000.

Food-niche overlap between yr was 0.329. Geometric mean weight of prey was 44.0 g in 1998, and 24.7 g in 2000, indicating that much lighter prey were consumed in the later yr (Table 1).

DISCUSSION

Prey composition in the owls' diet that we observed may have reflected changes in the small mammal fauna as a response to vegetational changes associated with fire. In 1998, the diet of Barn Owls was quite similar to that found in another site of similar characteristics (40°47′S, 71°07′W; Pillado and Trejo 2000). Both sites present a mixed small mammal fauna of forest and steppe-adapted species (Pearson and Pearson 1982). In this type of habitat, green-grass eaters (*R. auritus*) predominated in open areas, while scansorial species (*O. longicaudatus* and *L. micropus*) were associated with bushes, and also some wide-ranging species as *A. longipilis* were found (Pearson 1995, Guthmann et al. 1997, Lozada et al. 2000). In our study site, removal of vegetation by fire created a large patch of open habitat. This produced a decrease in species richness associated with reductions in vegetational complexity, and increases in the abundance of species suited to exploit open habitats (Ojeda 1989). Ojeda (1989) compared unburned and burned sites in the Monte desert of Argentina, and found that *E. typus* (closely related to *E. morgani*; Kelt et al. 1991) was more abundant in the burned sites (characterized by a low-vegetational cover) than in the unburned sites. He concluded that *E. typus* increased numbers in burned areas due to its general morphological and physiological adaptations to xeric existence in open habitats. *Eligmodontia morgani* is a small mouse commonly caught by aerial predators in open habitats (Pearson et al. 1987), a habitat association which may increase its risk of predation (Kotler 1984). Due to its small size, this species would be consumed by owls in absence of other energetically more profitable prey (Jaksic and Marti 1984). N. Guthmann (pers. comm.) live-trapped small mammals in burned and unburned areas shortly after the completion of our study (March 2001). Trapping in the burned site yielded more than 60% *E. morgani* by frequency of occurrence, followed by *R. auritus* (another open-habitat mouse; Pearson 1988).

The decrease of *L. micropus* and *O. longicaudatus* in the diet, rodents associated with bushy habitats (Pearson 1983), was probably also associated with the fires, which removed almost all vegetation.

Abrothrix longipilis maintained a similar proportion in the diet before and after the fires. This is a species associated with some vegetation cover (Pearson 1983), although can be found almost in all habitats from forests to arid zones. This flexibility in its habitat use probably enabled this species to survive after a severe transformation of the vegetation.

Although the number of pellets found in 2000 was not very large, the marked changes observed in the diet of Barn Owls after fire presumably show opportunistic behavior by this species. Instead of switching hunting area, to pursue a specific prey, Barn Owls shifted the diet as the prey community adjusted to vegetation changes. As other authors have observed (e.g., Bosè and Guidali 2001), the Barn Owl diet seems to reflect changes in the composition of the small mammal community, which are their main prey.

RESUMEN.—Se estudió la dieta de la lechuza de campanario (*Tyto alba*) durante dos períodos de tiempo en un área montañosa semi-árida del noroeste de la Patagonia argentina. Los períodos analizados fueron antes (1998) y después (2000) de que el área fuera afectada por in-

Table 1. Percent frequency (Freq) and percent biomass (Bio) of food items found in pellets of Barn Owls in northwestern Argentine Patagonia before (1998) and after (2000) the area was burned by fires (1999).

Prey Types	Mass (g)	1998 Autumn Percent Freq	1998 Autumn Percent Bio	1998 Winter Percent Freq	1998 Winter Percent Bio	1998 Spring Percent Freq	1998 Spring Percent Bio	1998 Pooled Percent Freq	1998 Pooled Percent Bio	2000 Pooled Percent Freq	2000 Pooled Percent Bio
Mammals											
Rodents											
Ctenomys haigi	146.2	1.5	4.5	—	—	—	—	1.1	3.2	4.3	19.3
Abrothrix longipilis	27.6	14.6	8.0	9.5	5.6	12.5	7.8	13.3	7.5	9.4	7.9
Abrothrix xanthorhinus	15.3	4.6	1.4	3.6	1.2	15.6	5.4	5.3	1.7	4.3	2.0
Akodon iniscatus	15.3	—	—	—	—	—	—	—	—	0.7	0.3
Chelemys macronyx	66.8	0.4	0.5	—	—	—	—	0.3	0.4	—	—
Eligmodontia morgani	17.5	4.2	1.5	—	—	3.1	1.2	3.2	1.1	52.2	27.7
Euneomys chinchilloides	84.7	0.8	1.3	—	—	—	—	0.5	—	—	—
Irenomys tarsalis	41.3	—	0.3	—	—	—	—	—	—	—	—
Loxodontomys micropus	56.2	26.2	29.2	31.0	37.1	18.8	23.9	26.6	30.5	0.7	1.2
Notiomys edwarsii	21.3	0.4	0.2	—	—	—	—	0.3	—	—	—
Oligoryzomys longicaudatus	24.1	3.8	1.8	21.4	11.0	21.9	12.0	9.3	4.6	2.2	1.6
Phyllotis xanthopygus	57.5	—	—	2.4	2.9	3.1	4.1	0.8	0.9	1.4	2.5
Reithrodon auritus	63.8	34.6	43.9	28.6	38.9	15.6	22.7	31.6	41.2	14.5	28.1
Unidentified rodents	43.3	8.5	7.3	3.6	3.3	6.3	6.1	7.2	6.3	5.8	6.1
Lagomorphs											
Lepus europaeus	235.0	—	—	—	—	3.1	16.7	0.3	1.3	—	—
Birds	70.0	—	—	—	—	—	—	—	—	1.4	3.1
Coleopterans	2.0	—	—	—	—	—	—	—	—	2.9	0.2
Total prey		260		84		32		376		138	
Total pellets		145		57		19		213		58	

cendios naturales sucesivos que destruyeron la vegetación casi completamente. En ambos períodos los roedores representaron más del 95% de las presas consumidas. Sin embargo, se observó un gran cambio en la composición de las mismas. En 1998, *Reithrodon auritus,* y otros roedores sigmodontinos asociados a ambientes arbustivos fueron los más consumidos. En 2000, *Eligmodontia morgani,* especie típica de microhábitats abiertos con suelo desnudo, representó más del 50% de la dieta, y las especies asociadas a arbustos casi desaparecieron. Nuestros resultados indicaron que *T. alba* fue un predador oportunista al alimentarse de pequeños mamíferos, y muy sensible a las modificaciones en la abundancia de las presas.

[Traducción de los autores]

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